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REGENERATION PROBLEMS AND RESEARCH IN CALIFORNIA 1/

By H. A. Fowells

Many of you no doubt have heard or found out by experience that artificial regeneration is a difficult problem in California. Some may believe that it is impossible. Planting and seeding admittedly are more difficult here than in some other forest regions. But we foresters shouldn't admit or even think the job to be impossible. We should, however, be aware of the factors which make the job difficult. It might be well, then, to consider what these obstacles to successful reforestation are and what is being done or should be done in the way of research to cope with them.

The most obvious and often used excuse for poor success in reforestation in California is that the weather is just too unfavorable. Obviously there isn't much we can do about the weather. But we can try to find procedures and techniques that will allow us to make the best of it. Fortunately the trees with which we are primarily concerned are adapted to this climate. Otherwise they wouldn't be here.

Climate makes the regeneration job difficult for at least two reasons. First, newly planted trees are often put under a severe moisture stress when warm dry days follow too closely on the planting period. We often find that much of the loss in planted stock occurs in the first month or so after planting, when there is available moisture in the soil. This loss results from the inability of the planted tree to absorb moisture fast enough. However, in experimental planting we have observed many times that trees carefully lifted from the nursery and immediately planted out are able to survive under severe conditions. In large-scale planting this care and timeliness may be difficult to attain. As a result, the root system is injured or degenerates and cannot absorb moisture adequately. There are several possible solutions.

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One procedure might be to condition the plants during storage or before planting so that a functioning root system is regenerated. So far attempts to do this by changing the storage conditions have not been successful. Treatment of the root system with various growth promoting substances has not been successful either. But certainly there are other techniques and substances which should be tried. Finding out how to condition planting stock is one of our most important research problems.

A second way of cutting down moisture stress is to lower the rate of transpiration. The most obvious way is to give the tree some shade. A more economical way--if it would work--is to use a transpiration retardant. These materials, used on ornamental plants by some nurseries, are waxy or latex coatings applied to the stems and leaves. So far we have been unable to demonstrate that these substances will increase survival. The problem of how these materials affect the moisture relations of the plant is now being studied in southern California.

Still another approach is to find trees which are better able to take the treatment we give them. These may be hybrids or selections from our own native species. Possibilities with hybrids now produced are many but a lot of field testing must be done. These field tests are just being started and will need to be continued as new hybrids are developed. Practically no work is being done on the selection of superior individuals except in the process of grading in the nursery. There is some experimental evidence here and from other parts of the world that careful grading of stock will eliminate individuals most apt to fail. Ultimately we should be able to grade stock to meet the severity of the planting conditions.

A very short planting season is the second major difficulty with our climate. The year 1952 is a good example. At the middle elevations of the Sierra Nevada, snow did not leave until May or even later. By then planting should have been finished. In the fall the soil did not become wet enough for planting in much of the mountains until the middle of November. And then the areas were snow covered. The uncertainty as to planting time, and the differences in growing seasons between the nursery and the planting sites make it necessary for us to lift stock and store it until it can be used. Although we have successfully stored stock over winter in experimental work, the techniques for long period storage need a lot more study. The problem may be solved only when we know how the plant is acting physiologically under storage conditions. And, of course, the storage problem is tied up with the process of stock conditioning mentioned earlier.

Another obstacle to successful regeneration is the rapid invasion of brush on logged or burned forest land. During their first year, planted trees or seedlings cannot compete successfully with established brush. How fast this brush develops is shown by conditions on the 1950 Wright's Creek fire on the Stanislaus National Forest. Here, two years after the fire, brush came in so quickly and densely that much of the area yet to be planted will need some form of brush eradication if planting is to succeed. From small-scale tests we know we can control most of the species of sprouting brush and seedlings with the 2,4-D types of spray. The big problem remaining is one of working out minimum dosages and economical spray techniques for large-scale operations.

Forest rodents and insects are also obstacles to successful regeneration in some areas. Several plantations in the brushfield reclamation program of northern California were badly damaged by snowshoe rabbits. Various attempts to control them by poisoning were ineffective. For example, in one large test there was only about 1 percent difference in amount of damage between trees treated with strychnine and untreated trees. Some prevention action is possible, though, because these rabbits will not venture far from cover for fear of predators. Thus damage by rabbits can be minimized if strips 10 or so feet wide, or blocks about 60 feet across, are cleared for planting.

Some insects, principally the pine reproduction weevil, have wiped out plantations or caused severe damage. The Bureau of Entomology has been able to control the weevil by aerial spraying. And the Institute of Forest Genetics is working on hybrids which appear to be resistant to the weevil. We should know, however, the conditions which lead to epidemics of the pest and thus be able to prevent them.

If we didn't have seed-eating rodents, most of the obstacles discussed so far could be dismissed. We could seed at will with reasonable assurance that we would get regeneration. Nature does the job occasionally by saturating the ground with such an amount of seed that rodents just do not take it all. By way of illustration, in a good seed year there may be 30,000 sugar pine seed or over 100,000 ponderosa pine seed per acre. This means 10-15 pounds of seed. Obviously, with seed worth $5 to $10 per pound, we cannot expect to duplicate Nature's method.

There are several possible solutions:

1. Get rid of the rodents temporarily,
2. Protect the seed by means of screens, or
3. Make the seed unattractive to the rodents.

Success in getting rid of the rodents by poisoning has been variable. We have not known what rodents we were trying to poison or what their habits were. However, studies by the Fish and Wildlife Service and by the Division of Zoology of the University of California are rapidly supplying the information. We should soon be able to plan an effective rodent control program.

A good many trials show we can direct-seed with wire screen cones. In some cases we have obtained 80 percent or better establishment. However, the screens are expensive to make and to use. And unless they are re-used six to ten times, there is no saving in cost over planting. Their utility may be greatest in areas inaccessible during good planting weather. Future work with screens should be directed towards reducing their initial cost and their use cost. The K-screen, a cylindrical screen, cheap to make and use, is one innovation being tested. It needs some improvement, however, to overcome certain limitations.

The most effective way of thwarting the rodents would be to make the seed unattractive to them. Hundreds of different materials have been tried--none of them effective. Recent tests by the Fish and Wildlife Service with a new compound, "Tetramine," indicate that this may be effective. Tetramine is a poisonous compound which apparently also has repellent qualities. Tests are being made with treated Douglas-fir seed on public and private land in northern California and the Forest Experiment Station plans some trials with ponderosa pine in 1953. Those who have used the material have high praise for it.

To sum up, then, California's climate makes the regeneration job difficult but not impossible. Better stock handling procedures and better stock will give success in planting. We know that we can control the competing brush but we need to get costs down. And, finally, through the concerted effort of several agencies, we are making progress on rodent control methods which will make direct seeding possible.